

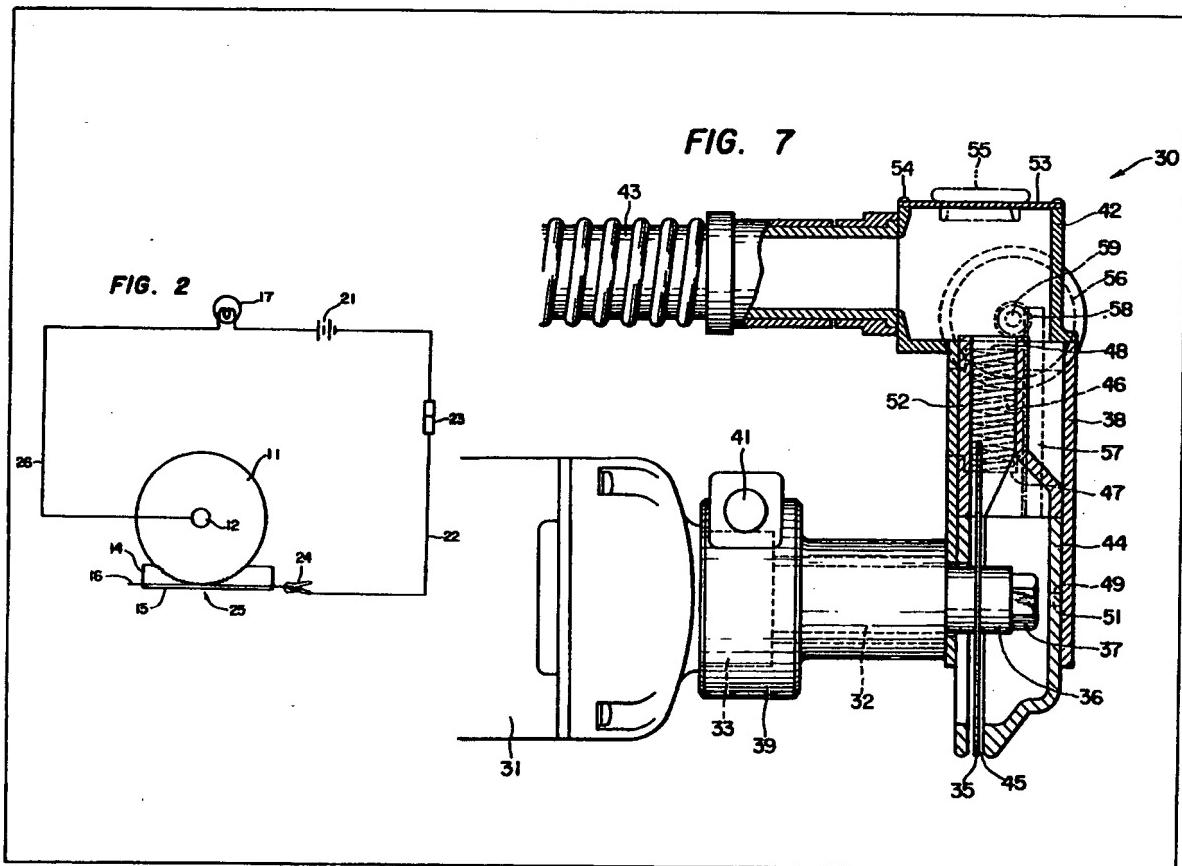
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(54) Dust proof plaster cast cutter and a safety device therefor

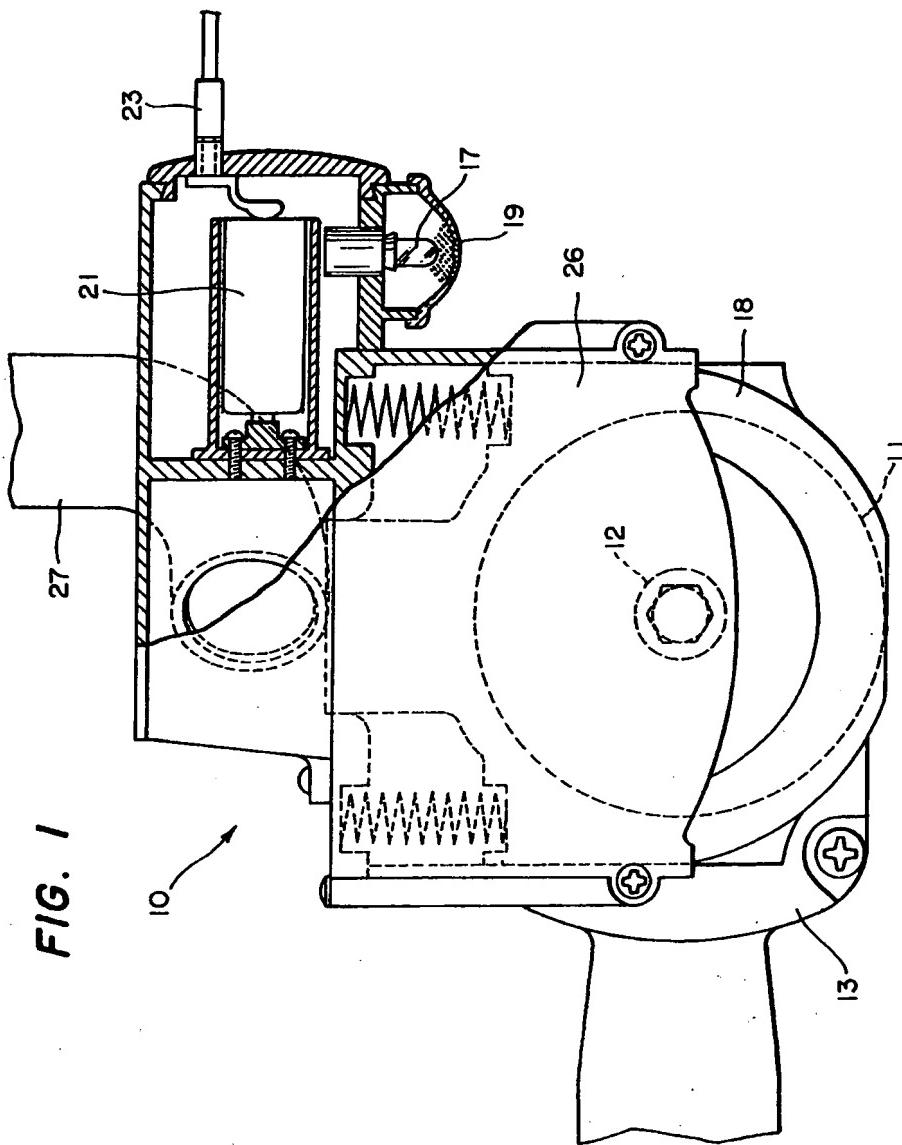
(57) An alarm device circuit includes an alarm device 17 and means 21 for energizing said alarm device; and a circuit breaking means connected in series with said alarm device and said energizing means, one terminal of the circuit breaker means being a conductor 16 embedded in a plaster cast 14 to be cut, which conductor is close to the skin of a patient and made of such a material as not to obstruct both the cutting operation by said cutting blade and the transmission of an X-ray, and the other terminal being cutting blade 11, whereby, when said cutting blade contacts said conductor, said alarm device circuit is made through said circuit breaking means thus to energize said alarm device.

The dust-proof plaster cast cutter comprises a cutting blade 35, means for operating said cutting blade 13, a casing 38 having its lower side opened, a blade cover 44 so fitted in said casing that it retracts as the cutting operation by said cutting blade proceeds, means 46 for urging said blade cover to cover said cutting blade, a suction hose 43 having communication with a vacuum source, a dust collection chamber 42 collected to said suction hose, and means 52 for providing communication between said dust collecting chamber and the inside of said blade cover irrespective of the moving position of said blade cover, whereby the dust or chips resulting from the cutting operation by said cutting blade are collected in the dust collecting chamber.



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2/7

FIG. 2

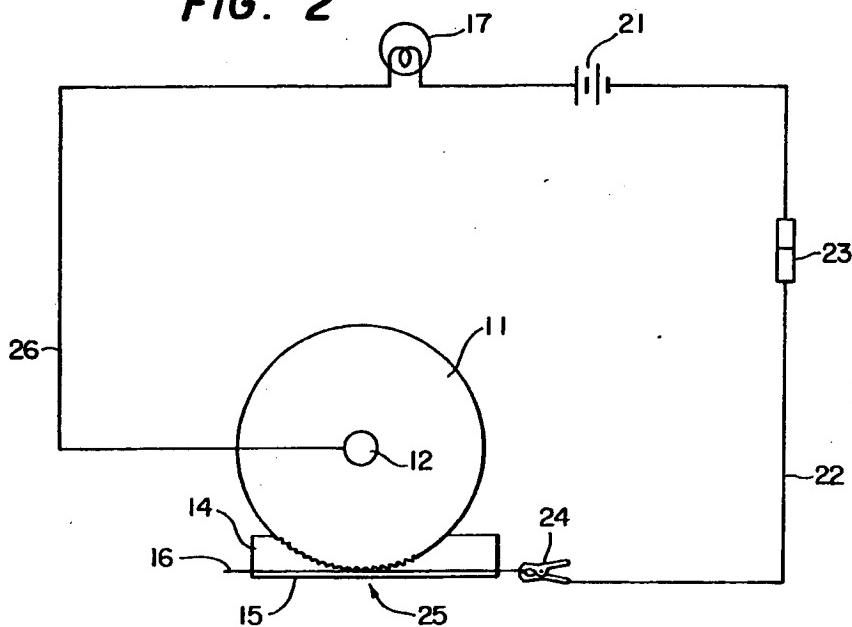
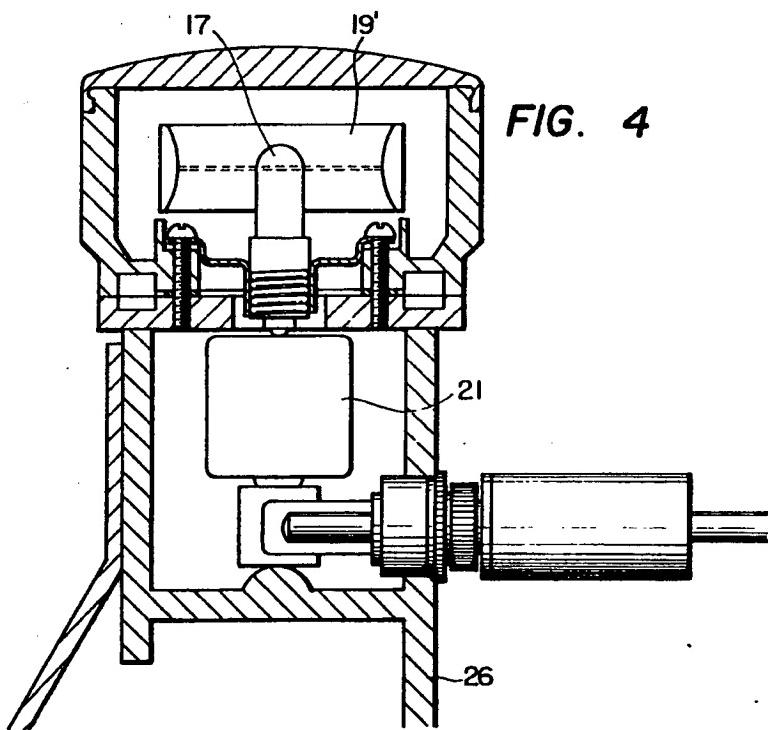


FIG. 4



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3/7

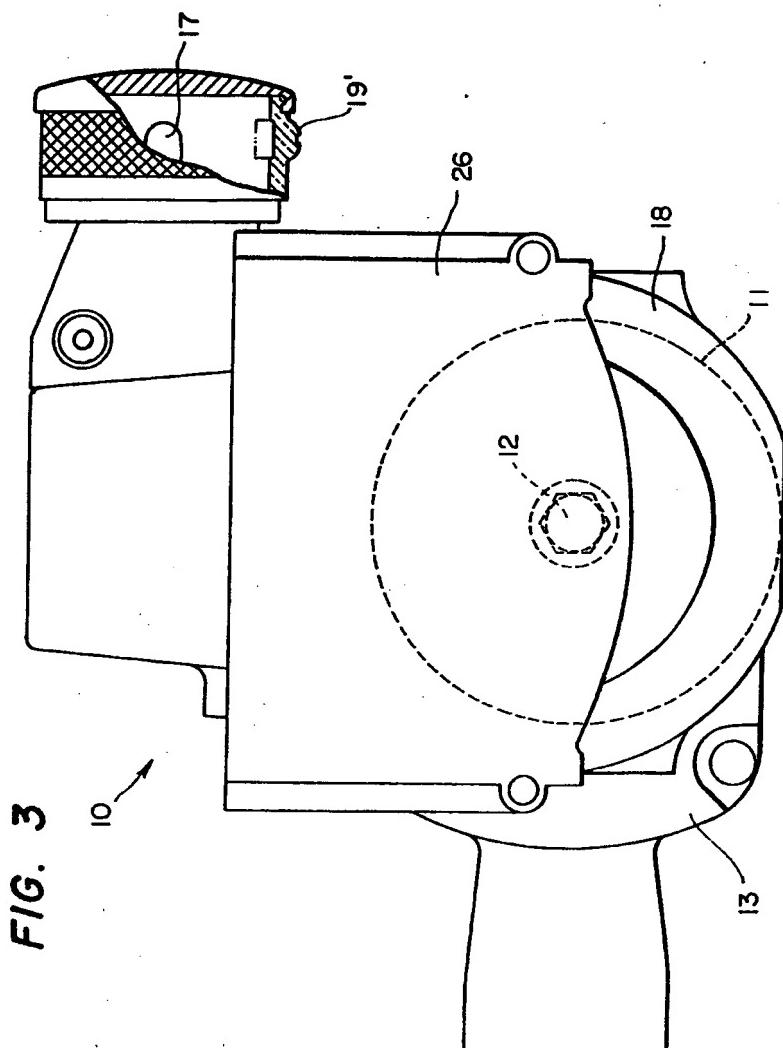


FIG. 3

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4/7

FIG. 6

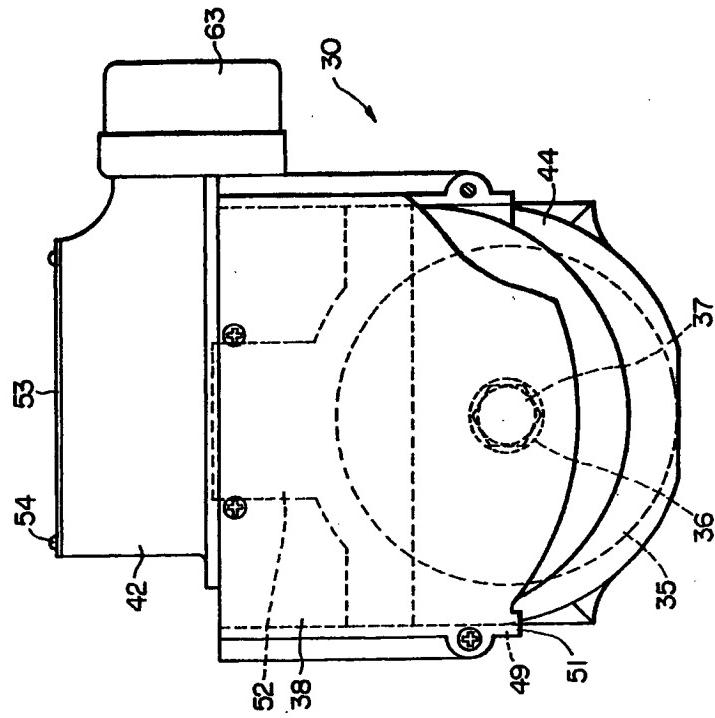
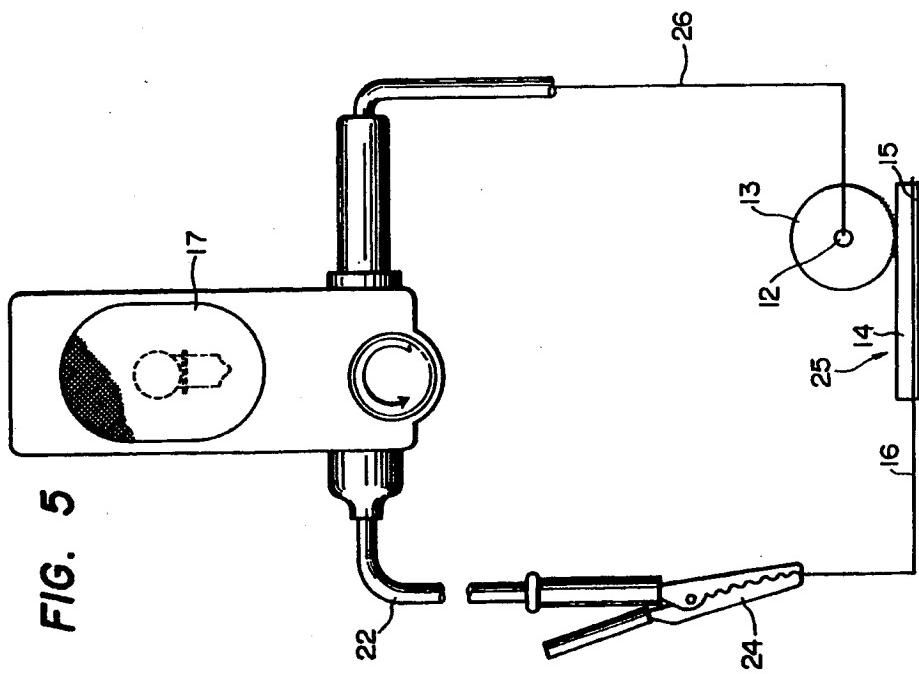
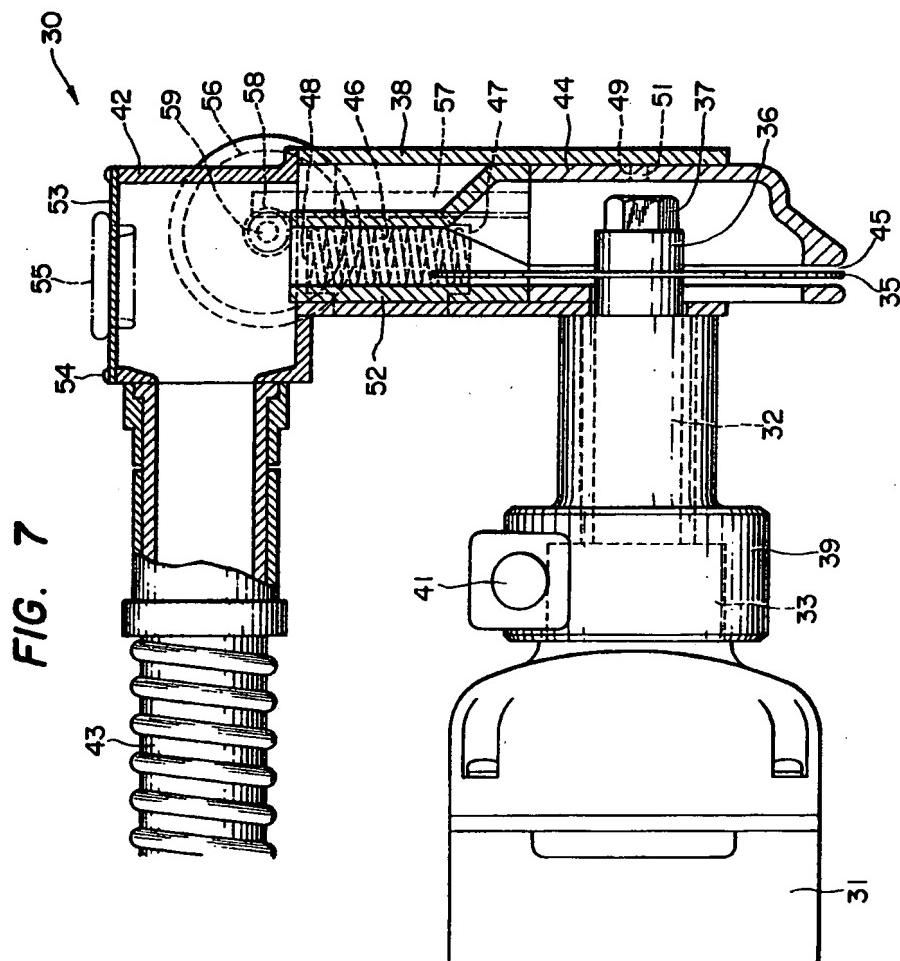


FIG. 5



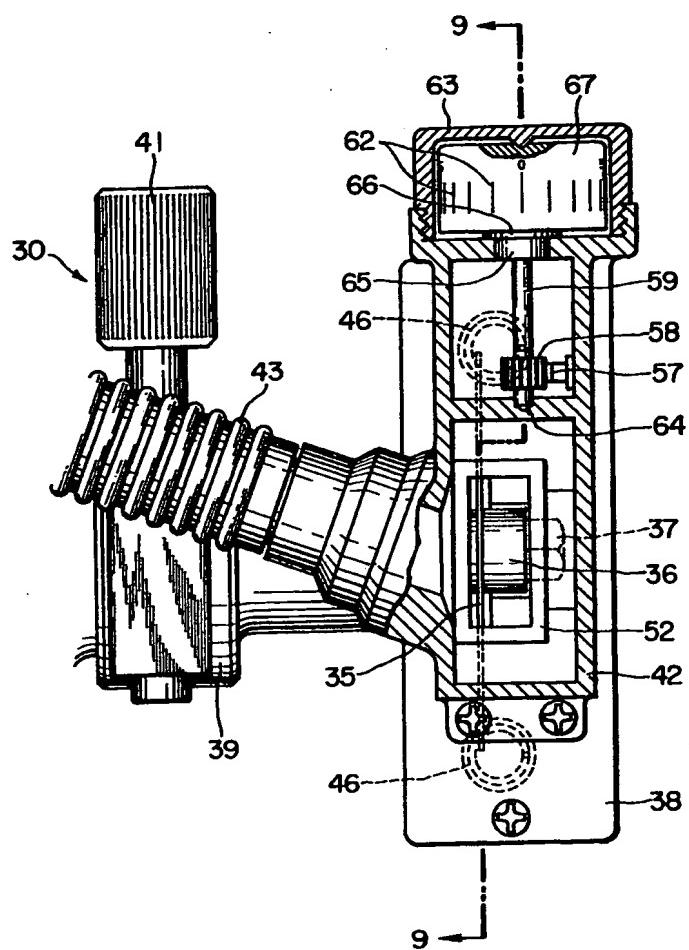
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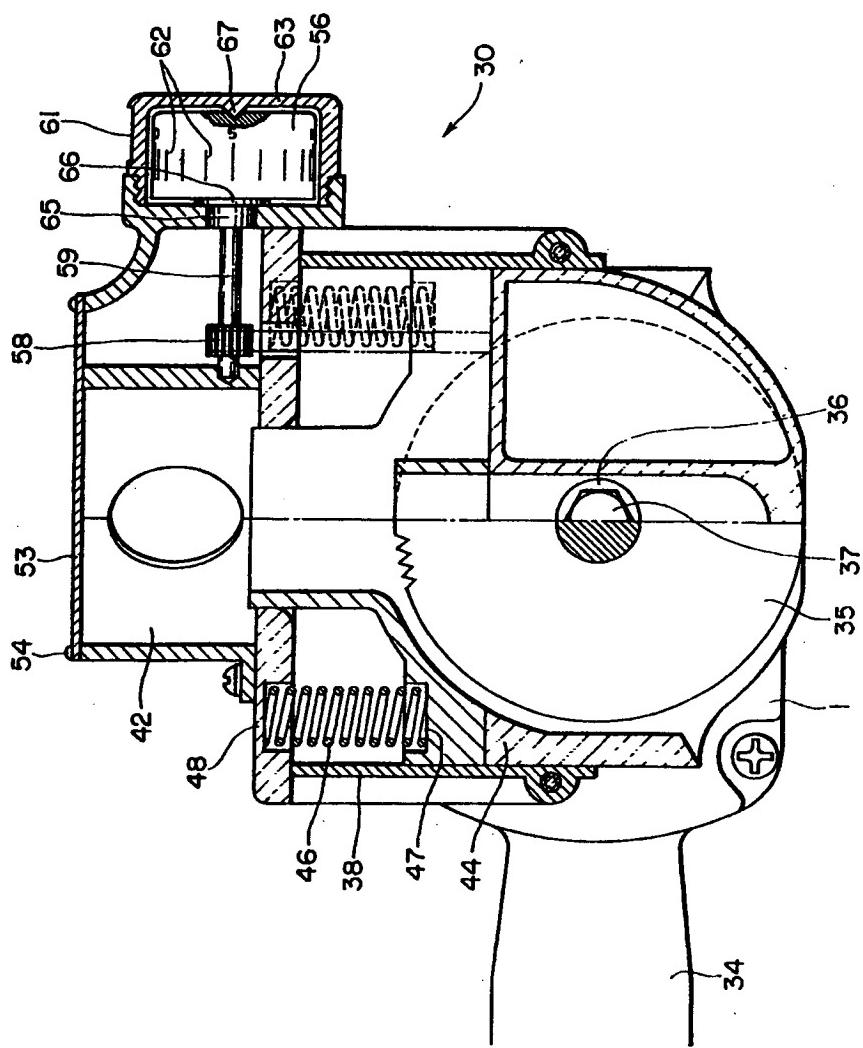
6/7

FIG. 8



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FIG. 9



SPECIFICATION

Plaster cast cutters

5 The present invention relates to a plaster cast cutter, and more particularly to both a dust-proof plaster cast cutter and a safety device therefor.

A plaster cast applied to the skin of a patient is cut using a plaster cast cutter while visually measuring the depth of cut by the cutting blade. Therefore, it is quite difficult to cut only the plaster cast without hurting the patient's skin, and the skin is frequently cut by accident even if the cutting operation is carefully performed. When the plaster cast is to be cut, therefore, the patient is horror-stricken whereas the doctor is excessively worried over his operation so that it takes a long time to complete the cutting operation. With this aspect of the plaster cast cutter in mind, it has been earnestly desired in the medical field to develop such a plaster cast cutter as detects the actual depth of cut so that it can easily cut only the plaster cast without any fear of hurting the patient's skin.

Another problem of known plaster cast cutters is that plaster dust or chips are generated during the cutting operation. Therefore, it has also been earnestly desired in the medical field to develop such a plaster cast cutter which will result in the doctor and the patient not breathing in the dust or chips without using dust-proof masks, so that the doctor can perform his cutting operation in a sanitary environment.

An object of the present invention is to provide a safety device for use with the plaster cast cutter which can detect the depth of cut during the cutting operation so that only the plaster cast can be cut without danger of harming the skin of a patient.

Another object of the present invention is to provide a plaster cast cutter wherein dust or chips produced by the cutting of a plaster cast may be collected.

According to one aspect of the present invention, there is provided a safety device for use with a plaster cast cutter including a cutting blade made of a conductive material and adapted to be brought to and from the skin of a patient for cutting, when actuated, the plaster cast which is applied to said skin of a patient, a prime mover for actuating, when energized, said cutting blade, and a power source for energizing said prime mover, said safety device comprising; and alarm device circuit including an alarm device for instructing, when energized, the operator of the cutting operation to interrupt his operation, and a power source for energizing said alarm device; and a circuit breaker unit connected in series with said alarm device and said power source and having a conductor embedded in said plaster cast in the vicinity of said skin of

a patient and made of such a material as never obstructs both the cutting operation by said cutting blade and the transmission of an X-ray, said conductor constituting one of the terminals of said circuit breaking unit whereas said cutting blade constituting the other terminal, whereby, when said cutting blade is brought to cut deeply into said plaster cast until it contacts with said conductor, said alarm device circuit is made through said circuit breaking unit thereby to energize said alarm device. Upon energization, this alarm device warns the end of the plaster cutting operation in terms of a light or sound. If the cutting operation is then interrupted and if the positions to be cut are consecutively shifted, only the plaster cast of any type can be reliably cut without hurting the patient's skin. Thus, during the cutting operation, the patient is neither horror-stricken, nor the doctor is worried over his operation, and the cutting operation per se can be completed within a remarkably short time. Therefore, remarkable prominent effects can be exhibited both in guarantee of safety of the cutting operation and in promotion of the cutting efficiency. Moreover, since the conductor used never obstructs both the cutting operation by the cutting blade and the transmission of the X-ray, the inspection using the X-ray is neither troubled nor the patient's skin is hurt by the cutting blade.

A preferred feature of the present invention is the construction of attaching the casing around the blade cover to a prime mover or a high-speed vibrating motor by means of a socket being universally applied to any plaster cast cutter using an identical high-speed vibrating motor thereby to ensure economy.

According to another aspect of the present invention, there is provided a dust-proof plaster cast cutter comprising: a cutting blade made movable to and from the skin of a patient for cutting, when actuated, the plaster cast which is applied to said skin of a patient; a prime mover for actuating, when energized, said cutting blade; a power source for energizing said prime mover; a casing having its lower side opened; a socket attaching said casing to said prime mover; a blade cover so fitted in said casing that it retracts into said casing as the cutting operation by said cutting blade proceeds; urging means for urging said blade cover out of said casing thereby to cover said cutting blade; a suction hose having communication with a vacuum source; a dust collecting chamber jointed to said casing and connected to said suction hose; and a sliding duct mounted slidably in said casing for always providing communication between said dust collecting chamber and the inside of said blade cover irrespective of the moving position of said blade cover, whereby the dusts or chips resulting from the cutting operation by said cutting blade are sucked from

said blade cover into said vacuum source by way of said sliding duct, said duct collecting chamber and said suction hose so that said cutting operation can be performed under a dust-proof condition.

Another preferred feature of the invention is that the retraction and protrusion of the blade cover is transmitted to an indicator through power transmission means so that the cut of depth by the cutting blade may be indicated by the indicator thereby to ensure the safe cutting operation while allowing both the doctor and the patient to feel comfortable.

This invention will now be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a partially sectional front elevation showing the construction of a safety device to be used as a plaster cast cutter according to one embodiment of the present invention;

Figure 2 is a wiring diagram showing the safety device of Fig. 1;

Figure 3 is similar to Fig. 1 but shows a modification of the safety device of Fig. 1;

Figure 4 is a sectional top plan view showing the electric alarm device of Fig. 3 in an enlarged scale;

Figure 5 is an explanatory view showing the general construction and wiring of the electric alarm device in case this device is arranged separately of the plaster cast cutter;

Figure 6 is a partially sectional front elevation showing a dust-proof plaster cast cutter according to another embodiment of the present invention;

Figure 7 is a partially sectional side elevation showing the dust-proof plaster cast cutter of Fig. 6;

Figure 8 is a partially sectional top plan view showing the dust-proof plaster cast cutter of Fig. 6; and

Figure 9 is a section taken along line 9-9 of Fig. 8.

Referring to Figs. 1 to 5, generally indicated at reference numeral 10 is a well-known plaster cast cutter, in which a saw-toothed cutting blade 11 having fine teeth is attached to the shaft 12 of a high-speed vibrating motor 13 made reciprocal with an amplitude of about 4 mm so that a later-described plaster cast is cut by the reciprocating motions of the cutting blade 11. Indicated at numeral 14 is a well-known plaster cast, in which tearable absorbent cotton 15 is applied to the portion to be brought into contact with the skin of a patient. There is placed on the absorbent cotton 15 a conductor 16 which is

made of such a material as never obstructs both the cutting operation by the cutting blade 11 and the transmission of an X-ray. This material is a metal such as aluminum in a foil, net or fibrous form. In an alternative, the material may be carbon in a powder layer

form. The conductor 16 thus made is inserted normally into such two positions of the plaster cast 14 as can be more easily cut. After that, gauze is fixed with calcined gypsum on the outer surface of the absorbent cotton 15, thus preparing the plaster cast 14. The aforementioned conductor 16 has its end bent on the outer surface of the plaster cast 14 so that the position thereof and accordingly the position

of the plaster cast 14 to be cut may be easily located. The bent end of the conductor 16 is clipped for electric connection by means of a later-described clip. Here, it is sufficient to embed the conductor in the plaster cast 14 at two positions because the plaster cast 14 is usually removed by being cut into two halves. In case, however, the plaster cast 14 is to be finely split, the number of the positions to be equipped with the conductor 16 may be three or more. On the other hand, if the positions to be cut cannot be specified, the conductor 16 is uniformly embedded all over the plaster cast 14 so that the cutting operation can be accomplished at any position. Indicated at

numeral 17 is an alarm device of electric or electronic type which is operative to generate a warning light or sound. In the case of the optical type, the alarm device 17 is attached to the cover 18 or the like of the plaster cast cutter 10 such that it is well visible when the cutting condition by the cutting blade 11 is to be inspected, as shown in Figs. 1, 3 and 4.

Then, the warning light emitted from the alarm device 17 is either scattered through a diamond-cut lens 19, as shown in Fig. 1, or condensed into a line beam through a lens 19', as shown in Figs. 3 and 4. If necessary, moreover, the electric alarm device 17 and a battery container may be assembled into such a unit as is independent of the plaster cast cutter 10 and may be placed at a visible position on a plaster cast 14 or not on a not-shown operation table. In the case of the audio type, on the contrary, the alarm device

110 17 need not have its attached or arranged position limited because it is sufficient that the warning sound can be heard. Indicated at numeral 21 it is a power source for the electric alarm device 17, which may usually

115 utilize a battery because it should have a low voltage so as to prevent any electric shock. However, the power source 21 may also utilize that of the aforementioned vibrating motor 13 if the voltage of the latter power source is

120 lowered by means of a resistor. Indicated at numeral 22 is one lead wire of the circuit of the electric alarm device 17, which is connected through an attachment plug 23 with the power source 21 and the alarm device 17

125 while being equipped with a clip 24 at its leading end. This clip 24 is used to clip the outside portion of the conductor 16 so that this conductor may constitute one terminal of the alarm device circuit thereby to provide a 130 fixed contact of the circuit breaking unit or

switch 25. Indicated at numeral 26 is the other terminal of the circuit of the alarm device 17, which is connected with the plaster cast cutter 10 thereby to provide the

5 cutting blade 11 as the other terminal of the alarm device circuit and as the movable contact of the switch.

Incidentally, the safety device thus far described can be used with any type of plaster

10 cast cutter with the resultant uniform safety effects. As shown in Figs. 1 to 3, more specifically, if the safety device is combined with the plaster cast cutter 10 of dust-proof type, as will be described later, in which the
15 blade cover 18 of closed type is movably fitted in a dust collecting chamber 26 connected to a suction hose 27, the dusts or chips which might otherwise be generated during the cutting operation can be prevented
20 from coming out so that the patient and the doctor can be protected from those noxious dusts or chips.

Since the embodiment of the safety device according to the present invention is con-

25 structed in the manner thus far described, when the cutting operation of the plaster cast 14 by the reciprocating motions of the cutting blade 11 is finished, this cutting blade 11 is brought into contact with the conductor 16
30 embedded in the plaster cast 14 in the vicinity of the patient's skin so that the switch 25 is turned on. At this instant, the electric alarm device 17 of light or sound type is operated to generate the warning light or sound warn-
35 ing that the skin is cut if the cutting operation further proceeds. In accordance with this warning signal, the cutting operation is interrupted to shift the cutting blade 11 to another position, thus consecutively accomplishing the
40 cutting operations. In this way, the cutting operations of the plaster cast can be completed within a short time without hurting the skin. Since the two positions having the conductors are usually cut, if the plaster cast 14
45 cut is opened, the absorbent cotton 15 left uncut is torn off so that the plaster cast 14 can be easily split into two halves and re-
moved from the patient.

According to the safety device of the pre-
50 sent invention, even if the cutting blade is carelessly applied to the plaster cast to be cut, at the instant when the blade touches the conductor or conductors embedded in the plaster cast in the vicinity of the patient's

55 skin, the alarm device circuit is made to operate the alarm device. If, at this time, the cutting operation is interrupted, only the plaster cast can be reliably cut without hurting the skin. During the cutting operation, therefore,
60 the patient is neither horror-stricken nor the doctor is worried over his operation so that he can complete his operation within a short time. Thus, there can be attained the effects that the inspection with the X-ray is not trou-
65 bled by the conductor and that the blade is

not damaged by the conductor.

Turning now to Figs. 6 to 9, the dust-proof plaster cast cutter according to the present invention will be described in the following.

70 Generally indicated at reference numeral 30 is the dust-proof plaster cast cutter of the present invention, in which a well-known high-speed vibrating motor 31 imparts reciprocating motions with an amplitude of about
75 4 mm to its shaft 32 protruding from a bearing 33 when a not-shown switch mounted on a grip 34. A cutting blade or saw 35 is attached to the leading end of the motor shaft 32 by means of a washer 36 and a nut
80 37. Indicated at numeral 38 is a casing which is attached to the high-speed vibrating motor 31 by fitting a socket 39 on the bearing 33 and by fastening a stop screw 41. The casing 38 has its underside opened, and a dust
85 collecting chamber 42 is attached to the upper portion of the casing 38. A suction hose 43 leading to a vacuum source is connected to the dust-collecting chamber 42. Indicated at numeral 44 is a blade cover which is
90 movably fitted in the casing 38 so that it retracts into and protrudes out of the casing 38. The blade cover 44 thus fitted has its circumferential underside formed with a slit 45, through which the cutting blade 35 is
95 brought into and out of the blade cover 44. More specifically, when the cutting blade 35 is forced into the plaster cast, the blade cover 44 is guided to retract into the casing 38 along the inner wall thereof. When the cutting
100 blade 35 is pulled upon interruption of the cutting operation, the blade cover 44 is made to protrude out of the casing 38 by the urging forces of springs 46 which are held between spring seats 47 formed on the shoulders of
105 the blade cover 44 and spring seats 48 formed on the casing 38 in a corresponding manner. The protrusion of the blade cover 44 is stopped at the lowermost position, where stoppers 49 formed at both the sides of the
110 intermediate portion of the blade cover 44 and hooks 51 formed on the casing 38. At the stopped position, the blade cover 44 encloses and covers the cutting blade 35. Indicated at numeral 52 is a sliding duct
115 which is mounted slidably in the dust collecting chamber 42 above the blade cover 44 thereby to provide at all times communication between the dust collecting chamber 42 and the inside of the blade cover 44 irrespective
120 of the moving position of the blade cover 44. Indicated at numeral 53 is a detachable cover which is fastened by means of screws 54 to the top of the dust collecting chamber 42. A scavenging small cover 55 made of rubber,
125 plastics or the like is removably fitted in a suitable portion of the detachable cover 53. Indicated at numeral 56 is a dial type indicator which is made indicative of the depth of cut of the cutting blade 35. A rack 57
130 mounted in the blade cover 44 is meshed

with a pinion 58, which is fixed to the shaft 59 of the indicator 56 so that the indicator 56 is turned in accordance with the movements of the blade cover 44 thereby to indicate the depth of cut of the cutting blade 35 into the plaster cast in view of the index 61 pointing to the scale 62 of the indicator 56. Indicated at numeral 63 is the cover of the indicator 56, which is screwed on one side of the dust collecting chamber 42 in a manner to enclose or cover the indicator 56 so that the operation of this indicator 56 may be performed smoothly without being interfered by an obstacle.

15 More specifically, the aforementioned indicator 56 is constructed to have its shaft 59 supported at its inner end in a pivot 64 and at its outer end in a bearing 65 which is formed with such a flange 66 as is made larger than the pinion 58 such that it is easily mounted by being inserted from the outside of the dust collecting chamber 42 and such that it has its center held by a needle 67 which is formed to protrude from the indicator cover 63.

20 Since the dust-proof plaster cast cutter exemplifying the present invention is constructed in the manner thus far described, when the cutting blade 35 is kept apart from the plaster cast, the blade cover 44 is urged to protrude out of the casing 38 by the urging forces of the springs 46 so that it is stopped at its lowermost position, as shown in Fig. 7, where the stoppers 49 and the hooks 51 engage, thereby to completely cover or enclose the cutting blade 35, as shown. On the contrary, when the cutting blade 35 is applied to the plaster cast and the high-speed vibrating motor 31 is gradually pushed, the cutting blade 35 cuts into the plaster cast, and at the same time the blade cover 44 is made to retract into the casing 38 so that the cutting operation by the cutting blade 35 can be accomplished smoothly. Moreover, the dusts or chips resulting from the cutting operation are sucked into the vacuum source or dust collector by the vacuum of the suction hose 43, which is applied to the blade cover 44 by way of the dust collecting chamber 42 and the sliding duct 52. Since the dust-proof cutting operation of the plaster cast is accomplished in that way, the doctor and the patient are prevented from breathing the dusts or chips during the cutting operation without use of a dust-proof mask so that the cutting operation can be accomplished in a sanitary environment. Moreover, when the high-speed vibrating motor 31 is pulled away from the plaster cast after the cutting operation has been completed, the blade cover 44 is instantly returned to protrude out of the casing 38 by the forces of the springs 46 until it covers the cutting blade 35.

In the dust-proof cast cutter, moreover, since the rack 57 is mounted on the blade cover 44, as shown in Fig. 8, and since the

pinion 58 fixed to the shaft 59 of the indicator 56 is meshed with the rack 57, the blade cover 44 is made to retract into the casing 38, as the cutting operation proceeds, and the indicator 56 is accordingly turned to consecutively change the scale 62 to be pointed by the index 61 so that the depth of cut by the cutting blade 35 is indicated. Therefore, if the cutting operation is accomplished in view of the indicated depth of cut, not only the doctor but also the patient can feel safe during the cutting operation.

CLAIMS

- 80 1. A plaster cast cutter including a cutting blade made of a conductive material, means for operating said cutting blade and a safety device comprising an alarm device circuit including an alarm device, means for energizing said alarm device, and a circuit breaking means connected in series with said alarm device and said energizing means, one terminal of the circuit breaking means being a conductor embedded in a plaster cast to be cut, which conductor is close to the skin of the patient and made of such a material as not to obstruct both the cutting operation by said cutting blade and the transmission of an X-ray, and the other terminal being said cutting blade, whereby, when said cutting blade contacts said conductor, said alarm device circuit is made through said circuit breaking means thus to energize said alarm device.
- 85 2. A plaster cast cutter as claimed in claim 1, wherein said alarm device is made operable with such a low voltage as to prevent any electric shock so that the energizing means for the alarm device has an accordingly low voltage.
- 90 3. A plaster cast cutter as claimed in claim 1 or 2, wherein said conductor is made of aluminum in a foil, net or fibrous form, or carbon in a powder layer form, placed in two or more block portions on the plaster coating.
- 95 4. A plaster cast cutter as claimed in claim 1, 2 or 3 wherein an end of said conductor protrudes from said plaster cast so that said conductor and accordingly the position of said plaster cast to be cut may be easily located and wherein a clip is detachably connected to said conductor end for connecting a warning means into said alarm device circuit.
- 100 5. A plaster cast cutter substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 5 of the accompanying drawings.
- 105 6. A plaster cast cutter comprising a cutting blade, means for operating said cutting blade, a casing having its lower side opened a blade cover so fitted in said casing that it retracts as the cutting operation by said cutting blade proceeds, means for urging said
- 110 120 130

- blade cover to cover said cutting blade, a suction hose having communication with a vacuum source, a dust collecting chamber connected to said suction hose, and means for
- 5 providing communication between said dust collecting chamber and the inside of said blade cover irrespective of the moving position of said blade cover, whereby the dust or chips results from the cutting operation by
- 10 said cutting blade are collected in the dust collecting chamber.
7. A plaster cast cutter as claimed in claim 6, further comprising means for indicating the depth of cut of said cutting blade in terms of
- 15 the moving position of said blade cover which retracts into said casing against the urging force of said urging means as said cutting operation proceeds and which is returned to protrude out of said casing when said cutting
- 20 operation is completed; and power transmitting means connected between said blade cover and said indicator for transmitting the moving position of the former to the latter.
8. A plaster cast cutter as claimed in claim 25 7, wherein said power transmitting means comprises a pinion fixed to the shaft of said indicator, and a rack attached to said blade cover.
9. A plaster cast cutter as claimed in claim 30 6, 7 or 8 wherein said blade cover has its underside split partly to allow said cutting blade to move therethrough into and out of said blade cover and partly to suck said dust or chips therethrough.
- 35 10. A plaster cast cutter as claimed in any one of claims 6 to 9 further comprising positioning means including stops formed on both sides of the intermediate portion of said blade cover, and lugs formed on said casing for
- 40 stopping said blade cover through engagement of the stops and lugs thus determining the lowermost position of said blade cover.
11. A plaster cast cutter as claimed in any one of claims 6 to 10, further comprising;
- 45 cover detachably fastened to the top of said dust collecting chamber; and a smaller cover removably fitted in the opening of said detachable cover for permitting easy access into the inside of said dust collecting chamber so
- 50 that said dust collecting chamber may be easily cleared of said dust or chips, if collected.
12. A plaster cast cutter substantially as hereinbefore described with reference to and
- 55 as illustrated in Figs. 6 to 9 of the accompanying drawings.